Ubiquitous Advance Automation

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***Abstract*—Ubiquitous computing is an advanced computing concept where computing is made to appear anywhere and everywhere. It uses web server with IP connectivity for accessing and controlling devices and appliances using Android based smart phone app. The proposed system consists of main two components: The first part is wired communication which consists of power line carrier communication using power line modem to communicate between two modules to control different home appliances like light, fan, room temperature etc and second part is wireless communication which uses web server to manage, control and monitor home appliances. User can locally(LAN) or remotely(RF) manage and control home appliances. The WI-FI technology is used to connect automated network.**

***Key words*—Web server, Android smart phone, WI-FI, LAN**

I. Introduction

Automation is today's fact, where more things are being completed every day automatically, usually the basic tasks of turning on or off certain devices and beyond remotely or through power line as well as web server. Ubiquitous computing is an advanced computing concept where computing is made to appear everywhere and anywhere. Ubiquitous advance automation may include centralized control of lightning, humidity, temperature, fan and other appliances. Power line carrier communication systems operate by impressing a modulated carrier signal on the A.C mains. This eliminates the need of using extra wires for communication [1]. Web server hosts a web site and provides reliable services for any requesting user. Any general purpose web server is composed of some kind of operating system, fast processor, special purpose hardware, large amount of memory, running applications and few web pages etc. Web servers are developed using general purpose computers. A web server can be embedded in a device to provide remote access for various appliances located at home ([6] [7]).Wi-Fi is a wireless technology that uses radio frequency to transmit data through the air. The data sent from mobile over Wi-Fi will be received by Wi-Fi module connected to raspberry pi microcontroller.

II. Operating Precept

Ubiquitous advance automation is done with wired and wireless technology both**.** In wired communication, power line carrier communication is used. Power line carrier communication refers to the concept of transmitting information using the mains power line as a communications channel. The PLC Modem is used for communication between different modules [1]. For wireless communication, web server is used which consists IP connectivity for controlling different appliances through android smart phone app [6][7].

A. Power line carrier communication

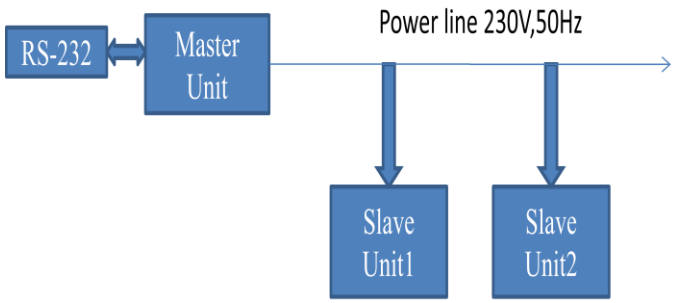

Figure 1 Diagram of Power line general Structure [1]

Power line carrier communication through wire is shown in Fig 1. The data are basically in analog form and it is converted to digital form for communication by using any digital modulation technique. Master Unit successfully communicates with Slave Unit through 230V, 50 Hz Power line. The Master Unit is connected to RS-232 socket for communication through power line. The Raspberry pi microcontroller at the Master unit sends data over power line.

B. PLC MODEM

PLC (Power Line Carrier) technology is based on the principle of controlling each unit connected to an Electrical socket by using the existing power line in the house. Electrical line is an analog environment and a translator unit is needed to make data communication on it. This unit must be a modem which modulates the digital data to analog at sender side and demodulate it to digital at receiver side. In this study, an integrated modem is used to supply communication between microcontrollers in the Master unit and slave unit. The TDA5051A is a modem IC, specifically dedicated to ASK transmission by means of the home power supply network, at 600 baud or 1200 baud data rate. It operates from a single 5 V supply. It works on protocol of ASK developed by NXP semiconductor itself.

TDA5051A is a 16 pin integrated modem produced by NXP. It can sends and receives data so it works in full duplex mode. Binary data modulation with ASK technique is shown here.

$$a(t) = \begin{cases} A\cos(2\pi ft) & \text{Binary 1} \\ 0 & \text{Binary 0} \end{cases}$$

In this modulation technique, the amplitude of the modulation signal is "0" for binary 0, and it is equal to the amplitude of the carrier signal for binary1.

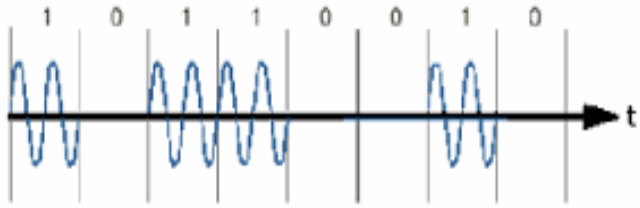

Figure 2 Amplitude shift keying.

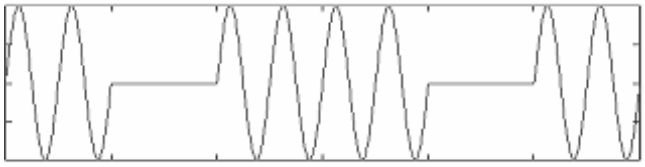

Figure 3 ASK signal of data '101101'

ASK is also called as on-off keying because of this property [1].

C. Web Server

Web server is a Raspberry pi ARM11 microcontroller including software and application code to monitor and control the systems. Microcontroller or ARM processor is an integral part of an embedded network and create a way for easy controlled activities of any device from any remote location. It processes on these signals (conversion from analog to digital) and then parameter values are stored in the memory. Status of the working devices or appliances is decided on the basis of stored values. Relays can be operated ON or OFF to change the status of devices as per our requirement. By comparing the standard values of parameters to be tested, further status of devices is decided. Thus purpose of automation works. For controlling the devices using web browser, owner of the system has to access the webpage and change the settings. It will be transferred to processor using serial port. Serial port is interfaced using driver/receiver interface. Sensed data is processed by microcontroller and continuously provides feedback to the website. One IP address is generated and the devices can be controlled through internet. The Android smart phone app is used for control ([6] [7]).

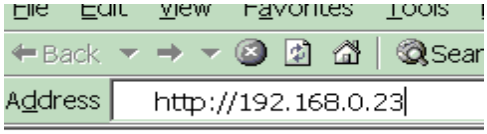

Figure 4 Entering the IP Address In to the web browser.

D. Master Unit

The Master Unit is shown in Figure 6.Raspberry pi microcontroller is used to control different devices. 230V supply line is there for controlling different devices like lamps, fans and other devices etc .For fan control a DIAC TRAIC based regulator is used. Relay drivers are there for switching on and off different lamps. Status of these appliances will be displayed by LCD. It also contains manual control. WIFI technology is used and controlling is done through Android smart phone as remote ([4][5][8][9]). It uses 802.11b standard. For controlling through internet LAN is operated [11].

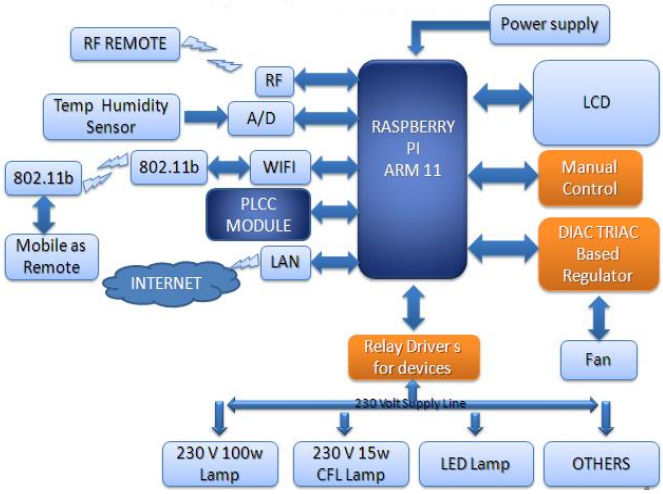

Figure 5 Master Unit

The RF is also operated for RF Remote [11]. Web server is designed with the help of Linux OS already contains Raspberry pi and coding is done for software approach. The temperature and humidity sensor is used to control temperature and analog to digital conversion is required to interface with microcontroller.

E. Slave Unit

The Slave Unit is shown in figure7. At mega microcontroller is used to operate different devices. Power line modem communicates between Master Unit controller and Slave Unit At mega controller. It communicates over power line to control different home appliances like lamp, fan, temperature and humidity control and gives command to switches on and off through relay driver circuit. Binary data are transmitted serially through power line and more than one Slave Units appliances are controlled same way as each Slave Unit contain one At mega controller.

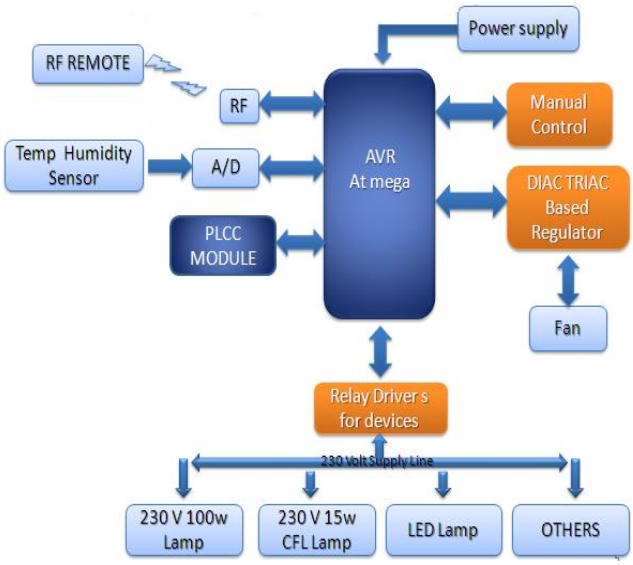

Figure 6 Slave Unit Diagram

III. RESULTS

The Figure 8 shows module of Slave Unit operated through power line and the status of lamp on and off can see on LCD. The other devices can on and off same way and its status can be displayed on LCD shown in Figure9.

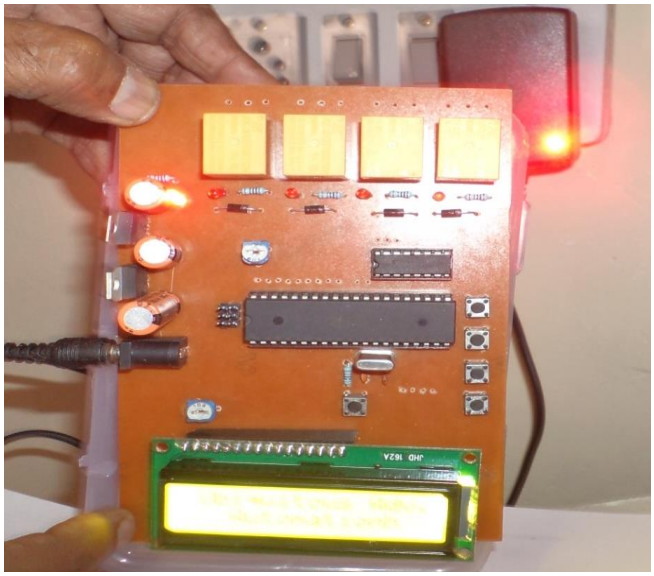

Figure 7 Slave Unit module

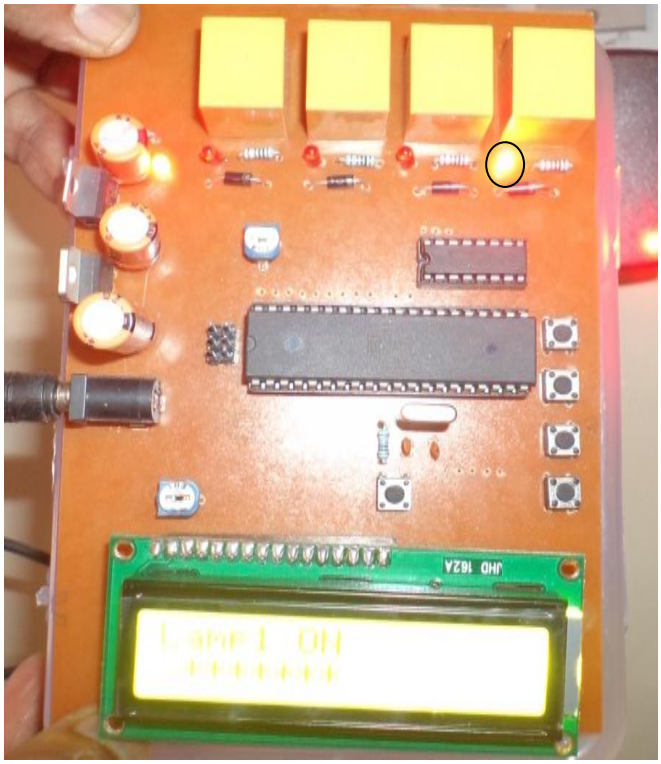

Figure 8 Status of Lamp 1 ON in LCD

Figure 9 Status of Lamp 1 OFF in LCD

IV. CONCLUSION AND FUTURE WORK

This is an ongoing project .Our prime objective is Ubiquitous advance automation. We can operate the most depreciated or debased technology which is not used in the market. In this study, automation with wired and wireless communication is done. The power line MODEM is used for power line carrier communication and devices controlled through power line. TDA5051A integrated modem for data transmission on the line make control units low cost, smart, and small sized simple structured. Web server with IP connectivity will be implemented to check the status of devices and to turn them on or off through internet. The design consists of Android phone which uses WIFI technology and contains 802.11b standard to control different devices wirelessly within a home. User can interact with the android phone and send control signal to the Raspberry pi which in turn will control other embedded devices/sensors. RF is also there to control various devices remotely. In future we focus on controlling various home appliances like door open/close, curtains open/close, HVAC control etc.

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